Assessment of Students' Holistic Development using Relative Temperature Profile and Relative Consciousness Level

Synopsis

Submitted in the partial fulfilment for the requirement of

Doctor of Philosophy

In

Electrical Engineering

Submitted By

Akshat Satsangi

Under the supervision of

Prof. Ravibabu Mulaveesala
(Co- Supervisor)
Centre of Sensors, Instrumentation and
Cyber Physical System Engineering(SeNSE)
Indian Institute of Technology Delhi
Hauz Khas, New Delhi – 110016

Prof. D. K. Chaturvedi
(Supervisor)
Department of Electrical Engineering
Faculty of Engineering

Department of Electrical Engineering, Faculty of Engineering

Dayalbagh Educational Institute (Deemed to be University)

Dayalbagh, Agra-282005

2023

Introduction

Thermal imaging is a technique used to convert the invisible radiation pattern of an object into visible images for feature extraction and analysis. Infrared thermal imaging technology can be applied in all fields where temperature differences could assist in the evaluation, diagnosis, or analysis of a process or product. It has a broad range of applications, including animals, agriculture, buildings, gas detection, industrial and military applications, as well as the detection, tracking, and recognition of humans. Thermal profiles are also used to detect emotions. The major advantage of infrared thermal imaging is its non-invasive, non-contact, and non-destructive nature, allowing for the determination of temperature distribution in any object or process of interest within a short period of time.

This research aims to identify the parameters of holistic development in students and establish their relationship with 1. Relative temperature profile and 2. Relative level of consciousness. A correlation will be established between the thermal energy of the body and the consciousness of students at different levels of education (primary, middle, and higher education levels). After establishing the correlation between these quantities, a model can be developed for holistic development using the relative temperature profile and relative level of consciousness. This aligns with the National Educational Policy (2020), which recommends the need to design technology-based software that will help in achieving educational goals. To support this, different educational boards (ICSE, CBSE) have introduced Artificial Intelligence as a compulsory subject from the 6th grade, along with various expert systems to assist teachers.

The Most Revered Sahabji Maharaj Sir Anand Sarup Kt., the fifth revered Leader of the Radhasoami Faith, mentioned that "Education, More Education, Education made perfect is the only panacea for all of the country's ills and evils."

For the holistic development of human beings, education at all three levels is important: physical, mental, and spiritual [Sat 2010, Sat 2011]. In the present educational system, there is a focus on physical and mental education for improving the outer self, but there is often neglect of the betterment of the inner self, i.e., spiritual education. In Dayalbagh, education is offered at all three levels, with an emphasis on maintaining a balance between the outer self and the inner self to develop a complete person.

The thermal cameras may be used to capture the thermal profile of students. Then, these thermal images will go through the following stages of processing:

1. Image acquisition and image enhancement
2. Image restoration
3. Colour image processing
4. Wavelets and multiresolution processing
5. Segmentation
6. Representation and description analysis

The results of thermal image processing will be used to correlate with different nodes/points of the human body, such as the forehead, the middle of the two eyes, the throat, the center point of the chest, and the center point of the stomach, in order to determine students' holistic development. The model for determining the holistic development of students from different age groups will be developed using a systems approach.

Literature Review:

This section provides a review of the literature related to the study, aiming to convey the knowledge and ideas that have been established on thermal imaging, consciousness study, and student holistic development. The purpose of this chapter is to precisely formulate the problem statement and establish the foundation for conducting the research. The review of previous literature aims to identify and state the objectives clearly and postulate the premise of the study. This chapter will review a number of studies that elucidate the concept of thermal imaging and its analysis using image processing. Furthermore, it will also review existing established studies on consciousness energy for the purpose of comparing the relative temperature profile. This section is divided into three subsections, namely thermal imaging, energy of the human body and consciousness, and students' holistic development.

a. Thermal imaging:

Thermal imager captures the images of any object using infrared (IR) radiations emitted by the objects. These types of imagers are commonly used in security systems and surveillance purpose. This is also used in defense systems to observe the enemies and their activities in night. There are numerous applications of these imagers such as faults identifications, detection, tracking and recognition of

animals, humans and live species [Gade 2014, Vad 2011, Wan 2012, Szw 2013]. In recent time thermal imaging is used to identify human emotions such as anger, sad, happy etc. [Yan 2016]. It is also used in leakage detection of electrical current [Nov 2013], roof [Zen 2013], gas [Jad 2014, Sow 2022] etc. For library activity of students, the thermal images are used [Jas 2015]. Potential use of thermal imaging in agriculture and food industry includes predicting water stress in crops, planning irrigation scheduling, disease and pathogen detection in plants, predicting fruit yield, evaluating the maturing of fruits, bruise detection in fruits and vegetables, detection of foreign bodies in food material, and temperature distribution during cooking [Vad 2011]. The health monitoring of electrical machines using thermal images also discussed by Chaturvedi et.al. [Cha 2022]. Detection of skin cancer at its early stages can improve the survival rate of patients [Mul 2021]. A theoretical study on the quantification of surface thermal response of cancerous human skin using the frequency modulated thermal wave imaging (FMTWI) technique was done. For the first time, the use of the FMTWI technique for the detection and the differentiation of skin cancer has been demonstrated by them. [Mul 2015]

Research gap: We could not find any paper which deals with the thermal imaging method for consciousness studies.

b. Energy of human body & Consciousness:

There are many ways to measure energy of human. It can be broadly classified as The temperature-based parameters (like mean differential temperature, relative percentage of raise / drop in temperature on different places in body) will be evaluated from thermal images, while the proven consciousness markers can be obtained from other direct measurement methods like 1. Measurement using physical quantities – Skin conductance – Frequency – Flux – light absorption 2. Measurement of brain activities through EEG, MRI etc. 3. Microtubule and consciousness AND indirect measurement methods like based on Verbal report [answers to questionnaire] (which is widely considered to be the most reliable indicator of consciousness).

Conscious experiences are the most subjective phenomenon and one of the highly debated topics in the last century. It was widely discussed in different scientific communities: philosophy, psychology, cognitive science, quantum physics, neuro- science, psychiatry, theology etc. (Cohen & schooler, 1997; Hameroff, Kuszaniak & Scott, 1998; Chalmers, 1996; Tart, 1975; Baars, 1986; Penrose, 1994; Satsangi,

2008; Wolman, & Ullman, 1986). Still there are not many theories regarding consciousness. [Son 2019] There can be different (6) dimensions of consciousness (i.e. physical, emotional, mental, spiritual, social-relational and self).

(1) Physical Consciousness: refers to the ability of being conscious of the body and organism, and of the physical elements of the environment.

(2) Emotional Consciousness: describes the ability of being conscious of your own emotions and feelings, and generally, to be conscious of any emotional feeling.

(3) Mental (Cognitive) Consciousness refers to the ability of being conscious of your own ideas, of the mental stream generally

(4) Spiritual Consciousness: refers to the ability of being conscious about yourself as a part of the universe, and describes the ability of being conscious about the multiple connections with the surrounding life.

(5) Social – Relational Consciousness: refers to the ability of being conscious about human relationships and the connections with the people you interact with

(6) Self-Consciousness: Consciousness of Self or Self-Awareness refers to the ability of being conscious about your own self; this factor describes the ability of the reflexivity of the human being, of being able to look upon itself in an objective way.

Student consciousness will change when they are dealing with different situations. During examination students feel happy if their performance in the examination was good and vice versa. The difference in consciousness level has been measured at eye center before and after examination by DEI-MEAD(Meridian Energy Analysis Devices). The correlation has been determined between the difference in consciousness level and students' performance. [Cha 2014b].

The consciousness energy measurement is discussed by measuring micro ampere current at different human body points like forehead, middle of two eyes , throat , center point of chest , center point of stomach etc . The correlation is established between this electrical energy and consciousness. [Cha 2014a].

Research gap: Measurement of higher-level consciousness using energy measurement sensor at different

age groups and relating with consciousness.

c. Holistic Development:

The holistic development of students encompassing their physical, mental, and spiritual well-being. It recognizes the importance of nurturing and enhancing various aspects of a student's personality, abilities, and skills beyond academic achievements. Overall development aims to create well-rounded individuals who can thrive in different aspects of life and contribute positively to society.

Physical development pertains to the growth and well-being of a student's body, including aspects such as motor skills, fitness, nutrition, and health. It emphasizes the importance of physical activities, sports, and a healthy lifestyle in promoting physical well-being.

Mental development focuses on nurturing a student's cognitive abilities, intellect, and emotional intelligence. It involves acquiring knowledge, critical thinking skills, problem-solving abilities, creativity, and emotional resilience. Mental development also includes promoting positive attitudes, self-esteem, and effective communication skills.

Spiritual development recognizes the inner growth and values that contribute to a student's moral, ethical, and spiritual dimensions. It encompasses aspects such as character development, empathy, moral values, compassion, and a sense of purpose and meaning in life. Spiritual development encourages students to cultivate a sense of connection with themselves, others, nature, and the larger world.

Overall development acknowledges the interdependence of these dimensions and seeks to create a balanced approach to education that addresses the diverse needs of students. It recognizes that academic knowledge alone is not sufficient for individuals to lead fulfilling lives but also emphasizes the importance of personal growth, social skills, and a sense of purpose.

Measurement of Values and Quality Impact on Holistic Personality Development of Students Application and Testing of VQEI across various Educational Models providing education at different levels (from Pre-nursery to Post graduate and research) [Son 2016]

Many studies were carried out for evaluating the one part of overall development which is - performance of student and they conclude that the conscious student is harder working, more aware; more involve in co-circular activities and have better efficiency to work. They also have good attendance in the class and have good behavior with other students and teachers.

Furthermore, conscious student has overall development and will give rise to evolution of complete man in all the aspects.

Research gap: No literature available which deals with the students' holistic development at different levels including primary, middle and higher educational level and relation with their consciousness.

Problem Statement:

Holistic development of student using Thermal Profile and measurement of consciousness level.

General:

Consciousness level of different chakras is well correlated with mental development, physical development. [Cha 2014b] [Cha 2013]

The research paper titled "Detecting Thermal Emotional Profile," presented by Yang Fu and Claud Frasson at the 3rd International Conference on Physiological Computing Systems in January 2016, investigates the utilization of thermal imaging to identify emotional states. [Yan 2016]

The significance of above research to our study lies in its exploration of thermal imaging as a means to analyze emotional states and establish correlations with students' overall development. While our research aims to evaluate holistic development and consciousness levels, Yang's paper emphasis on detecting emotional profiles through thermal imaging offers valuable insights.

By integrating the findings and methodologies presented in this paper, we can broaden the scope of our research to incorporate emotional states as a determining factor in assessing students' holistic development. This integration can contribute to a more comprehensive comprehension of the interplay between emotional well-being, consciousness levels, and overall development.

Considering the potential of thermal imaging in capturing emotional profiles and the relevance of emotions within the context of holistic development, the insights and techniques conveyed in this research paper can enrich the methodology and analysis of our study.

Hypothesis:

Holistic Development of an individual is directly proportional to their relative consciousness level and can be correlated with relative thermal profile of their body.

Objectives:

1. To acquire relative thermal profile of students of different age groups & Gender Separately and

analyze it to established relationship with holistic development.

2. Relative consciousness level measurement and its relationship with holistic development.
3. Prepare Model of holistic development using relative thermal profile and relative consciousness level.
4. Provide Feedback Mechanism .

Methodology:

We will use infrared thermal imaging cameras to capture the thermal profile of students. Then, we will process and analyze the images to determine the relative temperature distribution in the human body and correlate it with holistic development. The method will provide an automatic and non-invasive way of screening students for elevated or lowered levels of skin temperature, which can indicate higher or lower levels of consciousness.

Consciousness levels will be measured using the DEI-MEAD (Meridian Energy Analysis Devices) device and correlated with holistic development. Subsequently, a model for holistic development will be developed using the relative thermal profile and relative consciousness level.

Pilot Study:

This pilot study aims to determine consciousness levels by measuring microampere currents at the eye center and throat center using a sensor developed in the Department of Electrical Engineering, Faculty of Engineering, D.E.I., Dayalbagh, Agra, India. Measurements were taken from 30 B.Tech students before and after they completed a 20-minute examination of a class assignment (MCQ). The study establishes a correlation between the energies at different energy points and the students' performance (i.e., marks obtained in the class assignment). It was found that the correlation between the difference in energy at the eye center and throat center and the marks obtained is 0.94 and 0.41, respectively.

A similar study is conducted on the same group of students to determine the correlation between their relative thermal profile and their performance (i.e., marks obtained in the class assignment). It is found that the relative temperature profiles of students with better performance differ from those with poorer performance.

Future work:

When conducting research on the overall development of students, there are several concrete attributes

that we might plan to consider. These attributes provide a framework for evaluating and measuring the holistic growth of students :

1. Academic Performance: This attribute focuses on a student's achievements in academic subjects, including their grades, test scores, and overall knowledge acquisition. It assesses their understanding of various disciplines and their ability to apply learned concepts.
2. Physical Fitness: Physical fitness refers to a student's overall health and well-being in terms of physical activities, exercise, and nutrition. It involves assessing aspects such as cardiovascular endurance, strength, flexibility, and body composition.
3. Emotional Intelligence: Emotional intelligence refers to the ability to recognize, understand, and manage one's own emotions, as well as empathize with and relate to the emotions of others. It involves evaluating a student's self-awareness, self-regulation, social skills, empathy, and emotional resilience.
4. Creativity and Critical Thinking: This attribute focuses on a student's ability to think critically, solve problems, and generate innovative ideas. It assesses their creativity, logical reasoning, analytical skills, and ability to approach challenges from multiple perspectives.
5. Social Skills: Social skills encompass a student's ability to interact effectively and harmoniously with others. It involves assessing their communication skills, teamwork, leadership abilities, conflict resolution, and understanding of social norms and etiquette.
6. Moral and Ethical Development: This attribute evaluates a student's understanding and practice of moral values, ethics, and responsible behaviour. It involves assessing their integrity, honesty, empathy, respect for others, and ability to make ethical decisions.
7. Personal Development: Personal development focuses on a student's growth in terms of self-awareness, self-confidence, goal-setting, time management, and self-reflection. It involves assessing their ability to set and pursue personal goals, manage their time effectively, and reflect on their strengths and areas for improvement.
8. Cultural and Global Awareness: This attribute emphasizes a student's understanding and appreciation of different cultures, diversity, and global issues. It involves assessing their knowledge of different cultures, global perspectives, and their ability to engage in intercultural dialogue.

These attributes provide a comprehensive framework for evaluating the overall development of students. By incorporating these attributes our research, we can gain insights into the multidimensional growth of students and how different factors contribute to their overall development.

Conclusion:

The holistic development of students encompassing their physical, mental, and spiritual well-being. It recognizes the importance of nurturing and enhancing various aspects of a student's personality, abilities, and skills beyond academic achievements. Overall development aims to create well-rounded individuals who can thrive in different aspects of life and contribute positively to society.

This study proposes an approach that utilizes thermal imaging to assess the correlation between students' relative temperature profile and consciousness levels with their overall development. By analyzing thermal images and consciousness data, the research aims to develop a model for evaluating holistic development across different educational levels and establish a feedback mechanism for students and teachers which will help them to focus on the overall development.

The proposed temperature-based technique offers an automatic and non-invasive way to monitor students' skin temperature, serving as an indicator of their consciousness levels. This approach aligns with the belief that education should encompass physical, mental, and spiritual dimensions, and it can contribute to comprehensive improvements by monitoring various aspects such as academic performance, knowledge acquisition, ethical behavior, and quality of life. Additionally, a comparative analysis of holistic development between students in rural and urban areas can be conducted. Drawing inspiration from established energy measuring systems, this method can also provide insights into students' basic health conditions, which can influence their overall development.

References –

[Gad 2014]. Gade, R., Moeslund, T.B. Thermal cameras and applications: a survey. Machine Vision and Applications 25, 245–262 (2014). https://doi.org/10.1007/s00138-013-0570-5.

[Wan 2012] Wang, R., Wang, G., Chen, Z., Liu, J., Shi, Y.: An improved method of identification based on thermal palm vein image. In: Neural Information Processing, Lecture Notes in Computer Science, pp. 18–24. Springer, Berlin (2012).

[Vad 2011] Vadivambal, R., Jayas, D.: Applications of thermal imaging in agriculture and food

industry—a review.Food Bioprocess Technol. 4, 186–199 (2011).

[Szw 2013] Szwoch, G., Szczodrak, M.: Detection of moving objects in images combined from video and thermal cameras. In: Multimedia Communications, Services and Security, Communications in Computer and Information Science, vol. 368, pp. 262–272 (2013).

[Yan 2016] Yang Fu and Claud Frasson, Detecting Thermal Emotional Profile, Jan 2016, Conference: 3rd International Conference on Physiological Computing Systems, DOI: 10.5220/0006007901420151.

[Nov 2013] Novizon, N., et al. "Thermal image and leakage current diagnostic as a tool for testing and condition monitoring of ZnO surge arrester." Jurnal Teknologi 64.4 (2013).

[Jad 2014] Jadin, Mohd Shawal, and Kamarul Hawari Ghazali. "Gas leakage detection using thermal imaging technique." 2014 UKSim-AMSS 16th International Conference on Computer Modelling and Simulation. IEEE, 2014.

[Sow 2022] Sowndarya, G. S., and C. Shanthi. "Visualization and Evaluation of Methane Gas Leakage by Thermal Image Processing Using Supervised Deep Learning Models." Artificial Intelligence and Evolutionary Computations in Engineering Systems. Springer, Singapore, 2022. 187-206.

[Zen 2013] Zeng, Xiao Wen, and Yong Mei Zhang. "Application Of The Roof Leakage Infrared Detection Technology." Applied Mechanics and Materials. Vol. 401. Trans Tech Publications Ltd, 2013.

[Jes 2015]. Jesper Haglund, Fredrik Jeppsson, David Hedberg and Konrad J Schönborn, Thermal cameras in school laboratory activities, June 2015, IOP Publishing Ltd Physics Education, Volume 50, Number 4 , 424.

[Vad 2011] Vadivambal, R., Jayas, D.S. Applications of Thermal Imaging in Agriculture and Food Industry—A Review. Food Bioprocess Technol 4, 186–199 (2011). https://doi.org/10.1007/s11947-010-0333-5

[Nat 2022].National Policy of EducationAvailableat https://www.mhrd.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf, 2022.

[Cha 2014b] Chaturvedi D.K., Satsangi Rajeev, “The correlation between Student Performance and Consciousness Level”, International Journal of Computing Science and Communication Technologies,

Vol. 6, No. 2, Jan 2014,pp. 936-939. (ISSN 0974-3375).

[Cha 2014a]Chatruvedi D.K. and Lajwanti "Correlation between Energy Distribution profile and Level of Consciousness" International Journal of Education, Vol. 4(1), pp. 1-9, 2014

[Cha 2013] Chaturvedi D.K., Manish Arya A study on Correlation between Consciousness Level and Performance of the Worker, Journal of Industrial Engineering, Vol. VI, Issue No. 8, 2013, PP. 40-43.

[Ras 2017] Rastogi, R., Chaturvedi, D.K., Sharma, S., Bansal, A., & Agrawal, A. (2017), "Audio Visual EMG & GSR Biofeedback Analysis for Effect of Spiritual Techniques on Human Behaviour and Psychic Challenges", Journal of Applied Information Science, 5(2), 37-46. http://www.i- scholar.in/index.php/jais/article/view/167372

[Cha2022] Chaturvedi D. K. and. Singh M. P, Health Monitoring of Induction Motor using Thermal Images, The Journal of Central Power Research Institute CPRI, Vol. 16(2)/105-114, July-December 2020. DOI : 10.33686/pwj.v16i2.151493.

[Cha 2019] Chaturvedi D.K., Chakra Energy, Meditation and Consciousness, 5th Student Conference on Engineering and Systems (SCES-2019), May 29-31, 2019 at Dept. of Electrical Engineering, Motilal Nehru National Institute of Technology Allahabad, Pryagraj, India.

[Cha 2015] Chaturvedi D K, Jyoti Kumar Arora and Ravindra Bhardwaj, Effect of meditation on Chakra Energy and Hemodynamic Parameters, International Journal of Computer Applications, 126(12):52-59, September 2015.

[Ras 2017] Rastogi Rohit, D. K. Chaturvedi, Navneet Arora, Santosh Satya, Pankhuri Singh, Study on the Efficacy of Electroencephalography and Galvanic Skin Resistance Biofeedback with Mindful Meditation on Mental Health of Youths, International Journal of System and Software Engineering Vol. 5 (2), 1-13 , December 2017 , ISSN.: 2321-6107.

[Tsa 2010] Tsai Hui Chu., Chaturvedi D.K., B. Agarwal, H. Cohly, V. Kumar, "Spiritual Meditation and Physical Environment Influence the Energy Detected by M.E.A.D.", International Conference on Religion of Saints (SANTS) – Radhasoami Mat Spirituality and Consciousness Studies (SPRICON – 2010), organized by DEI, Dayalbagh, Agra, 12-14 Nov. 2010, pp.137

[Ras 2018] Rastogi R., Chaturvedi D.K., Arora N., Trivedi P., Singh P., Vyas P., Study on Efficacy of

Electromyography and Electroencephalography Biofeedback with Mindful Meditation on Mental health of Youths, in Proceedings of the 12th INDIACom; INDIACom-2018; IEEE Conference ID: 42835, Technically Sponsored by IEEE Delhi Section 2018, 5th International Conference on "Computing for Sustainable Global Development", 14th – 16 March, 2018 at BharatiVidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi (INDIA)) ISSN 0973–7529 and ISBN 978-93-80544-14-4, pp 84-89.

[Cha 2019] Chaturvedi D.K., Gur Charan Singh and Gurpreeti Singh, "Consciousness and Effect of Meditation: An Experimental Study", Int. Conf. on Toward the Science of Consciousness, Inter Laken, Switzerland, June 25- 28, 2019, pp. 257.

[Sat 2010] Satsangi P.S. (2010), Cosmology from the twin vantage points of Radhasoami Faith and Systems Science, Vission Talk, Int. seminar on Religion of Saints („Sant") – Radhasoami Faith, DEI, Dayalbagh, Agra.

[Sat 2011] Satsangi P.S. (2011), Cosmology of Consciousness: Towards Quantum – Theoretic Systems Modeling: Spirit- Mind-Brain Interaction, Vission Talk, CONCENT – 2011, Inaugural Workshop of the Centre for Consciousness Studies, DEI, Daylbagh, Agra, Abstract – pp. 50-67.

[Rav 2015] Suitability of frequency modulated thermal wave imaging for skin cancer detection-A theoretical prediction PMID: 25965019 DOI: 10.1016/j.jtherbio.2015.03.007

[Rye 2011] "Education for sustainable development and holistic curriculum change." The Higher Education Academy, York Science Park, Heslington, York.

[Son 2016] Education for Holistic Development: Researching for Value and Quality Based Education Index (VQEI) DOI:10.13140/RG.2.2.26759.04003

[Son 2016] A Study of Consciousness Of University Students In Relation to The Academic Achievement And Level Of Education https://doi.org/10.52634/mier/2016/v6/i1/1458

[Son 2019] Journal of Consciousness Exploration & Research| November 2019 | Volume 10 | Issue 8 | pp. xxx-xxx Saxena, S. P., Ahuja, S., & Brazdau, O., Conscious Experience & Cognitive Ability: A Correlational Analysis

[Rav 2021] R Mulaveesala, G Dua , V Arora, Computer-aided diagnosis methods for non-invasive imaging of sub-skin lesions, CRC Press, Taylor & Francis Group, 2021.